Meteo and hydrodynamic conditions governing the recent evolution of the Ebro delta

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Since the end of the forties -when the construction of large dams in the lower Ebro valley began-, the Ebro delta front has behaved as a stretch of poorly-nourished sandy coast under the action of both the local meteorology and marine hydrodynamics (S.-ARCILLA *et al.*, 1990).

The main role of meteo agents is driving or influencing the water motions off the Ebro delta. Apart from that, the wind stress acting on the local sediments produces noticeable eolian transport in some areas such as the Fangar dune field and the Trabucador bar (fig. 1). Strong prevailing "mestral" winds from the NW may produce alongshore drifts of sediments compensating for a small part of the littoral transport at the Fangar area, whereas the (unfavourable) effect of the mestral winds on the Trabucador bar is migration of sand from the backshore to the beachface.

Wind waves (i.e. high-frequency water motions) and associated surf-zone currents appear to be the primary driving mechanism for the sediment transport in the Ebro delta coast. Available directional wave data show that "llevants" -seas and swells from the NE or E directions- are the most energetic sea states and account for most of the wave energy flux reaching the Ebro delta (GARCIA *et al.*, to be published. See fig. 2). This is coherent with the directions of the alongshore littoral transport derived from sediment budget calculations (JIMENEZ *et al.*, 1990).

Tidal motions do not seem to have any remarkable influence on the large-scale evolution of the Ebro delta coast. Data retrieved from local tide gauges yield a tidal range of ca. 20 cm (LOPEZ, to be published). Surges associated to storm events are a much more important factor that astronomical tides. Meteo- induced elevations of the mean sea level (MSL) of 50 cm are not exceptional, as they may happen more than once per year. The effect of these surges is clearly understood when storm events like that of 8th to 11th October, 1990 are considered. As described in JIMENEZ *et al.* (1991), the elevation of the MSL favoured then a break-through of the Trabucador bar under high-but-not-too-high wave height conditions.

Low-frequency motions, ranging from inertial oscillations to quasi-steady currents, are only capable of transporting sediments either near the Ebro mouth -where the amount of suspended sediments is relatively important- or at deeper locations, provided that waves produce resuspension of bottom sediments. Field results from CACCHIONE *et al.* (1990) show that such a process hardly occurs beyond the delta "mud belt", which extends as deep as 20 m. On the other hand, advection of material may not follow the prevailing current direction to the SW but be instead affected by mesoscale phenomena such as spatial variations of the wind stress field and transient water exchanges across the shelf edge (GARCIA, 1990; TINTORE *et al.*, 1990), which can give rise to local gyres of different character.

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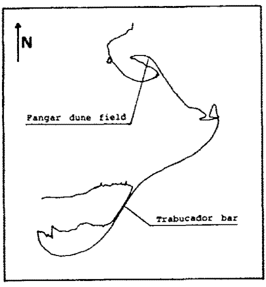

Fig. 1 Location of the Fangar dune field and the Trabucador bar within the Ebro delta.

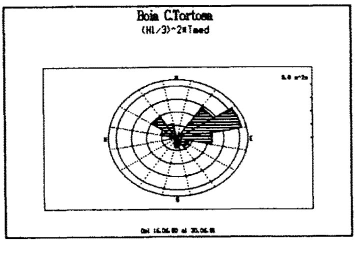

Fig. 2 Distribution of the local mean wave energy flux at deep water.

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